

What is claimed is:

1. A method of making a thin-film device, the method comprising:
providing a substrate having a major surface area, the substrate having a first layer on a first surface area of the substrate's major surface area;
depositing a second layer onto the first layer, wherein the first and second layers form part of a battery; and
depositing one or more other layers on the battery to form a photovoltaic cell.
2. The method according to claim 1, wherein the depositing of the second layer further includes supplying an amount of ion-assist energy to the second layer to aid in crystalline layer formation while controlling a stoichiometry of the crystalline layer without substantially heating the substrate, and wherein the battery is a thin-film lithium battery.
3. The method according to claim 1, the method further comprising:
attaching an integrated circuit to the substrate; and
operatively coupling the integrated circuit to charge the battery using current from the photovoltaic cell.
4. The method according to claim 1, wherein at least some of the layers are deposited on the substrate while the substrate moves in a continuous motion.
5. The method according to claim 1, wherein the substrate is a flexible material supplied from a roll, and at least some of the layers are deposited on the substrate while the substrate moves in a continuous motion.
6. The method according to claim 1, wherein either the first or the second layer forms a cathode layer of the battery, wherein the battery includes the cathode layer, an anode layer, and an electrolyte layer located between and electrically isolating the anode layer from the cathode layer, wherein the anode or the cathode or both include an intercalation material.

7. The method according to claim 1, further comprising depositing an electrical circuit on the battery.
8. The method according to claim 1, wherein the substrate is a rigid material supplied from a cassette, and at least some of the layers are deposited on the substrate while the substrate moves in a continuous motion.
9. The method according to claim 1, wherein the substrate is a polymer material having a melting point below about 700 degrees Celsius.
10. The method according to claim 1, wherein the depositing of the second layer includes supplying ion-assist energy to the second layer using ions of at least 5eV.
11. The method of claim 2, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 5 eV to about 50 eV.
12. The method of claim 2, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 5 eV to about 30 eV.
13. The method of claim 2, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 5 eV to about 20 eV.
14. The method of claim 2, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 10 eV to about 50 eV.
15. The method of claim 2, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 10 eV to about 20 eV.
16. The method of claim 2, wherein the supplying of ion-assist energy includes supplying

ions having an energy in the range of about 20eV to about 50 eV.

17. The method of claim 2, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 20eV to about 30 eV.

18. The method of claim 1, wherein the supplying of ion-assist energy includes supplying ions having an energy of about 20 eV.

19. The method according to claim 1, wherein the depositing of the second layer further includes supplying an amount of ion-assist energy to the second layer to aid in crystalline formation of a layer that includes lithium while controlling a stoichiometry of the crystalline second layer.

20. The method according to claim 1, wherein the depositing of the second layer further includes supplying an amount of ion-assist energy to the second layer to aid in crystalline layer formation while controlling a stoichiometry of the crystalline second layer without substantially heating the substrate, and wherein the battery formed is a thin-film battery.

21. The method according to claim 2, wherein the second layer is a LiCoO_2 intercalation material, and the supplying of ion-assist energy includes supplying ionized oxygen that combines with LiCo to form the LiCoO_2 intercalation material.

22. The method according to claim 2, wherein the providing of the substrate comprises:
supplying a substrate base; and
depositing the first layer onto the substrate base to form the substrate, wherein depositing of the first layer includes supplying ion-assist energy to the first layer to aid in crystalline layer formation while controlling a stoichiometry of the crystalline first layer without substantially heating the substrate base.

23. The method according to claim 2, wherein the providing of the substrate includes

supplying a flexible material supplied from a roll, and the depositing of the second layer on the substrate is performed while the substrate moves in a continuous motion, wherein the second layer forms an electrolyte layer of a battery, wherein the battery includes a cathode layer, an anode layer, and the electrolyte layer located between and electrically isolating the anode layer from the cathode layer, wherein the anode or the cathode or both include an intercalation material.

24. The method of claim 2, wherein the supplying of energy to the first layer includes supplying energy from a high-intensity photo source.

25. The method of claim 2, wherein the supplying of energy to the first layer includes supplying energy from a high-temperature, short-duration heat source.

26. The method of claim 2, wherein the supplying of energy to the first layer includes supplying energy from a short-duration plasma source.

27. The method of claim 2, wherein the supplying of energy to the first layer includes supplying energized particles from a second source simultaneously with supplying electrolyte material from a first source.

28. The method of claim 2, wherein the supplying of energy to the first layer includes supplying laser energy to the surface.

29. The method of claim 1, wherein the depositing of the second layer includes depositing adatoms to form the second layer as a film.

30. A method of making a thin-film device, the method comprising:
supplying a substrate having a major surface area; and
depositing a plurality of layers onto the substrate including
supplying energy while depositing a first layer to aid in crystalline layer formation

while controlling a stoichiometry of the crystalline first layer without substantially heating the substrate; and

supplying energy to a second layer having a different composition to aid in crystalline layer formation while controlling a stoichiometry of the crystalline second layer without substantially heating the substrate.

31. The method of claim 30, wherein the first layer and the second layer form at least part of a battery, and wherein the method further includes depositing one or more other layers on the battery in order to form a photovoltaic cell.

32. The method of claim 30, wherein the supplying of energy to the first layer includes supplying energy from a high-intensity photo source.

33. The method of claim 30, wherein the supplying of energy to the first layer includes supplying energy from a high-temperature, short-duration heat source.

34. The method of claim 30, wherein the supplying of energy to the first layer includes supplying energy from a short-duration plasma source.

35. The method of claim 30, wherein the supplying of energy to the first layer includes supplying energized particles from a second source simultaneously with supplying electrolyte material from a first source.

36. The method of claim 30, wherein the supplying of energy to the first layer includes supplying laser energy to the surface.

37. The method of claim 30, wherein the supplying of energy to the first layer includes supplying ion-assist energy with ions of a first energy, and the supplying of energy to the second layer includes supplying ion-assist energy with ions of a second energy different than the first energy.

38. The method of claim 30, wherein supplying of the substrate includes supplying a continuous set of wafers.
39. The method of claim 30, wherein the first and second layers form parts of a thin-film battery.
40. The method of claim 30, wherein the first and second layers form parts of a capacitor.
41. The method of claim 30, wherein the first and second layers, respectively, form parts of a thin-film battery and a device powered by the thin-film battery, respectively.
42. The method of claim 30, wherein the first and second layers, respectively, form parts of a thin-film battery and a device powered by the thin-film battery, respectively, wherein the device is deposited onto the thin-film battery.
43. The method of claim 30, further comprising depositing a set of traces for electrically connecting a device to the thin-film battery.
44. The method of claim 43, further comprising placing one or more components onto the traces.
45. The method of claim 30, further comprising depositing an energy-conversion device on the thin-film device.
46. The method of claim 30, wherein the substrate is a polymer material having a melting point below about 700 degrees Celsius.
47. The method of claim 30, wherein the energizing of the second layer includes supplying ions of at least 5eV.

48. The method of claim 30, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 5 eV to about 50 eV.

49. The method of claim 30, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 5 eV to about 20 eV.

50. The method of claim 30, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 10 eV to about 20 eV.

51. The method of claim 30, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 20eV to about 30 eV.

52. The method of claim 30, wherein the supplying of ion-assist energy includes supplying ions having an energy of about 20 eV.

53. The method of claim 48, wherein the substrate is a polymer material having a melting point below about 700 degrees Celsius, and wherein the energizing of the second layer includes supplying ions of at least 5eV.

54. A method of making a thin-film device, the method comprising:

providing a substrate base;

depositing a first layer onto the substrate base, wherein the depositing of the first layer further includes supplying an amount of ion-assist energy to the first layer to aid in crystalline layer formation without substantially heating the substrate;

depositing a second layer onto the first layer, wherein the first and second layers form part of a battery, wherein the depositing of the second layer further includes supplying an amount of ion-assist energy to the second-layer to aid in crystalline layer formation without substantially heating the substrate, and wherein the battery is a thin-film lithium battery; and

depositing one or more other layers on the battery to form a photovoltaic cell,.

attaching an integrated circuit to the substrate; and
operatively coupling the integrated circuit to charge the battery using current from the photovoltaic cell.

55. The method of claim 54, wherein the supplying of ion-assist energy includes supplying ions having an energy in the range of about 5 eV to about 50 eV.

56. The method of claim 54, wherein the substrate is a flexible material supplied from a roll, and at least some of the layers are deposited on the substrate while the substrate moves in a continuous motion.

57. The method of claim 54, wherein the substrate includes a polymer material having a melting point below about 700 degrees Celsius.